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## Energetics and ordering in strongly correlated oxides as seen in optics

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*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2003

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Presura, C. (2003). *Energetics and ordering in strongly correlated oxides as seen in optics*. s.n.

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## Acknowledgements

I think that if we reflect on who we are, or how we got here, we may discover a debt to others that would span a large space-time continuum. Many people who lived centuries ago succeeded, through their discoveries, to crucially influence our present-day life. Others, which we have met one day, may have stepped into our oblivion next day. I believe it is appropriate to acknowledge all of these unknown persons, and it is also necessary to acknowledge those people which we still remember, those we know that have directly shaped our lives and our work. The studies described in this thesis were performed in the Optical Solid State Physics group, University of Groningen, the Netherlands, and it is thus my pleasure to have this opportunity to express my sincere thanks to those who have contributed to this work in one way or another.

In particular I would like to express my gratitude towards my promotor Dirk van der Marel and my co-promotor Paul van Loosdrecht, for the valuable support, encouragement and guidance they have given me in these four years. With a strong theoretical knowledge, Dirk helped me orient better in the multitude of outputs my experiments generated. In every group meeting he tried to rise the scientific standard of our communications and the one of our understanding as high as possible, stretching our brains to limit sometimes. Putting a lot of passion in what he is doing (this sometimes just floods like rivers to his students), in many cases looking like a pure Jules Vernes designed scientist, Dirk is a model for all of us, and all I can wish him for future is an even greater success in Geneva! To Paul I wish to warmly thank for the whole technical and theoretical help I received since he came in our group. Thanks to him I was able to grasp some knowledge on Raman spectroscopy techniques, and to finish the work on  $\beta\text{-Na}_{0.33}\text{V}_2\text{O}_5$ , despite some difficulties. I wonder how many versions of the paper he corrected. More than ten?

The work on  $\alpha'\text{-NaV}_2\text{O}_5$  presented in the third chapter of this thesis is a compilation of results obtained with the support and enthusiasm of a number of individuals. As an experimentalist, I should acknowledge first my sample provider, R. K. Kremer. Not only that he provided me with the samples of  $\alpha'\text{-NaV}_2\text{O}_5$ , but also with single crystals of  $\alpha'\text{-Na}_{1-x}\text{Ca}_x\text{V}_2\text{O}_5$ , difficult to obtain at the time. Milan Konstantinovic borrowed me the samples of  $\alpha'\text{-Na}_x\text{V}_2\text{O}_5$ , where I was able to measure a resonance predicted by him in a previous paper. I am indebted also to H.J. Bron for his assistance with the chemical analysis of the  $\alpha'\text{-Na}_{1-x}\text{Ca}_x\text{V}_2\text{O}_5$  crystals, and to Anton Chezan for his RBS checks. In the end, a lot of theoretical input was supplied by two very good theoreticians, Maxim Mostovoy and Liviu Hozoi. I am grateful for the cooperation I had with Maxim not only on  $\alpha'\text{-NaV}_2\text{O}_5$ , but also on  $\beta\text{-Na}_{0.33}\text{V}_2\text{O}_5$ . This gave me the also opportunity to admire how he tried to find always the "key" experimental value giving the most important "clue" about the physics involved. With Liviu is probably the other way around, since I have tried to keep him "with the feet on the ground", reminding him how the experimental results put always constraints, but nevertheless I really appreciate his new approach on  $\alpha'\text{-NaV}_2\text{O}_5$ .

The forth chapter, namely the work on  $\beta\text{-Na}_{0.33}\text{V}_2\text{O}_5$ , was made possible by Prof. Dr. Yutaka Ueda, who supplied us with very high quality samples. Besides this, we had a vivid e-mail correspondence with him over the physical properties of  $\beta\text{-Na}_{0.33}\text{V}_2\text{O}_5$ . I acknowledge here my gratitude to him for the time he devoted to me in this way. We performed more structural studies on these samples in the group of Prof. Dr. Tom Palstra, together with his Ph.D. student Gabi Maris. I would like to thank here Gabi for all the work she put in this project. Tom Palstra deserves double acknowledgments, since I've received from him a lot of feed-back, encouragements and expert advice, not only for the work on  $\beta\text{-Na}_{0.33}\text{V}_2\text{O}_5$ , but also for the one on  $\alpha'\text{-NaV}_2\text{O}_5$ . Thank you, Tom! Even though last on this list, my former undergraduate Mihaita Popinciuc deserves congratulations not only for his careful way of building up an experimental set-up, but also for his patience of listening dissertations on history and politics during the long nights of measurements.

The work presented in the last chapter on  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$  was initiated by Prof. Dr. Tony Leggett, after an idea developed by him in one of his previous works. Later, during our encounters, his suggestions were gladly welcomed, together with the ones of his former student Misha Turlakov. They gave me the chance to put the problem in the right context, and to find the best way of extracting the needed information from the experimental data. The outcome may not have a strong point in the way we wanted, but, nevertheless, it may be useful. I would like to express my profound gratitude to Tony also for the careful reading of the thesis and his critical comments, together with the ones of the other two members of the reading committee, Prof. Dr. Mark Golden and Prof. Dr. Daniel Khomskii. The experimental results were obtained in collaboration with one of my best friends in Groningen, Hajo Molegraaf. We tried carefully to acquire the crucial data, including the one on the mid-infrared ellipsometer, where he performed all the work, and where he is the boss (he created the software to make it run, together with a useful software library used by all of us). Besides this, Hajo had a big influence in my attitude towards life, which I hope it will not go away (the attitude I mean...). He taught me how to be more flexible and accept things which I may not like, and how to be open. With my warmly thanks, all I can say is "Good luck Hajo!", your future looks good!

Apart from my main projects, I was also involved in other projects, some of them being partly presented in the second chapter. In this way, I have had many times the wonderful experience to feel that, in some small way, I helped someone. I am grateful for the cooperation which Diana Rata proposed me on  $\text{VO}_x$ , where we tried to measure and interpret the optical spectra, under the careful supervision of dr. Hao Tjeng and Prof. Dr. T. Hibma.  $\text{UGe}_2$  was another example, where I enjoyed collaborating with Diana Dulic, Montu Saxena and Catalin Didraga. Diana taught me how to better polish the samples, and make me wonder what precisely goes in the mind of girls, a general question still unanswered by humanity. I am also indebted to Dana Borsa for the collaboration on  $\text{Cu}_3\text{N}$ , to Alexey Kuz'menko for the one on  $\text{CuO}$ , and to Peter Steeneken for the magneto-optic measurements on  $\text{EuO}$ . Alexey, thanks for all the answers you gave me to my technical questions, and Peter, we will probably meet more often at Philips, but still, thanks! At last, but not the least, I would like to thank Hakan Yetkiner, with his exotic work (for me) in economics. It made more confident that there are other things which I may do in life as well. Good luck in future Hakan!

However many collaborations, my daily life spined around my own group. Besides

the people already mentioned (Alexey and Hajo), I enjoyed a lot discussing with Patricio Mena. Patricio, you know what we wait from you and Anita! My roommate Artem Tsvetkov was a cheerful presence, and a good "answering machine" for short questions. Artem, thanks a lot not only for your warm friendship, but also also for the help you provided hosting me for two weeks! Cor Bos, our technician, gave me apples, screwdrivers, and headaches when he dismounted without notice my carefully aligned systems. However, everything was forgiven and compensated by his beautiful design of our new cryostat, and his crucial role in keeping the instruments running. Thanks Cor, and success with your French! I am also indebted to Frans van der Horst for his continuous technical support at the Unix station. And since no work succeeds without a good lunch, I would like to thank Katarzyna Karpinska and Arjen Kamp for the their welcomed presence. During my first years in the group, I've learned a lot from my predecessors Andrea Damascelli and Markus Grüninger, a pair of very good experimentalists. I think that me and Hajo always tried to do at least as good as they did. In those beginning years, also the help of Jeroen van der Eb and Anna-Maria Janner was heartily welcomed. But all our work would not have been efficient without the big help our secretary, Renate Nieborg. Thanks Renate, I really appreciate the kindness with which you tried to solve our complicated "paper works".

Coming from Romania in the Netherlands was for me like walking on a time bridge. However, it came to me as a surprise how many simple things I missed (sun, backyard farm, old friends, you name it...), and how the mother tongue is the easiest way to express your feelings. Fortunately, I had my Romanian friends, from RUG (Alex, Andrei, Catalin, Mihaela, Oana, Marius, Ionut, Bogdan, besides the ones already mentioned) and outside RUG (Ion, Dora, Mark, Simona, Mejdí, Gabi, Rodica, Razvan) to alleviate this homesickness. I would like to thank them all, with special mention to Flori and her husband Toni.

A great help in the beginning of my formation as physicist came from people from the Institute of Atomic Physics, Bucharest. I think that a great teacher was lost when dr. Stoicescu chose to continue in research, but that gave me the opportunity to meet him, and to learn to try to look always beyond the boundaries of what I am doing. Research was however the best choice for Prof. Dr. Voicu Lupei and his wife dr. Aurelia Lupei, who helped me in a crucial moment of my life, and who showed me by personal example the way a scientist should work, for which I would like to warmly thank them as well.

Last, but not the least, I would like to thank my wife Iulia.